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EXAMINER
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SHARON, AYAL I

ART UNIT	PAPER NUMBER
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2123

DATE MAILED: 12/02/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

## Office Action Summary

Application No.

10/024,359

Applicant(s)

KHAN, MOHAMMED ASIF

Examiner

Ayal I. Sharon

Art Unit

2123

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

### Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

### Status

- 1) ☒ Responsive to communication(s) filed on 21 December 2001.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

### Disposition of Claims

- 4) ☒ Claim(s) 1-58 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-58 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

### Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 21 December 2001 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

### Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
  2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
  3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

### Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date 12/21/2001.
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_.
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_.

## DETAILED ACTION

### *Introduction*

1. Claims 1-58 of U.S. Application 10/024,359, originally filed on 12/21/2001, have been presented for examination.

### *Claim Objections*

2. Claim 7 is objected to because of the following informalities: "... by symbolically" should be "... be symbolically". Appropriate correction is required.

### *Claim Rejections - 35 USC § 101*

3. 35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

4. **Claims 1-58 are rejected under 35 U.S.C. 101 because the claimed invention is directed to non-statutory subject matter.** The claims, as written, are directed to the manipulation of an abstract idea - a mathematical algorithm. The claimed invention is therefore not concrete or tangible. See MPEP §2106 (A), and *In re Warmerdam*, 33 F.3d 1354, 1360, 31 USPQ2d 1754, 1759 (Fed. Cir. 1994). See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459.
5. An invention which is eligible for patenting under 35 U.S.C. § 101 is in the "useful arts" when it is a machine, manufacture, process or composition of matter, which

produces a concrete, tangible, and useful result. The fundamental test for patent eligibility is thus to determine whether the claimed invention produces a “**useful, concrete and tangible result.**” The test for practical application as applied by the examiner involves the determination of the following factors:

- “**Useful**” - The Supreme Court in *Diamond v. Diehr* requires that the examiner look at the claimed invention as a whole and compare any asserted utility with the claimed invention to determine whether the asserted utility is accomplished. Applying utility case law the examiner will note that:
  - i. the utility need not be expressly recited in the claims, rather it may be inferred.
  - ii. if the utility is not asserted in the written description, then it must be well established.
- “**Tangible**” - Applying *In re Warmerdam*, 33 F.3d 1354, 31 USPQ2d 1754 (Fed. Cir. 1994), the examiner will determine whether there is simply a mathematical construct claimed, such as a disembodied data structure and method of making it. If so, the claim involves no more than a manipulation of an abstract idea and therefore, is nonstatutory under 35 U.S.C. § 101. In *Warmerdam* the abstract idea of a data structure became capable of producing a useful result when it was fixed in a tangible medium which enabled its functionality to be realized. See MPEP §2106 (A). See also *Schrader*, 22 F.3d at 295, 30 USPQ2d at 1459.

- **"Concrete"** - Another consideration is whether the invention produces a "concrete" result. Usually, this question arises when a result cannot be assured. An appropriate rejection under 35 U.S.C. § 101 should be accompanied by a lack of enablement rejection, because the invention cannot operate as intended without undue experimentation.
6. The Examiner respectfully submits that under current PTO practice, the claimed invention does not recite *either a useful, tangible or a concrete result*.
- a. The claimed invention is not useful because neither the specification or the claims provide a specific use for the claimed invention.
  - b. The method claims are not tangible because only a mathematical construct is claimed.
  - c. None of the claims are concrete because there is no identifiable output.
- Since there are no results, results are not assured.

### ***Claim Rejections - 35 USC § 112***

7. The following is a quotation of the second paragraph of 35 U.S.C. 112:
- The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.
8. Claims 1, 23, 55, and 58 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. Claim 1 recites the limitation "the term " in line 3 of the claim. The other claims have the same defect. There is insufficient antecedent basis for this limitation in these claims.

***Claim Rejections - 35 USC § 102***

9. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

10. The prior art used for these rejections is as follows:

- Feehery, W.F. et al. "A Differentiation-Based Approach to Dynamic Simulation and Optimization with High-Index Differential-Algebraic Equations." SIAM Computational Differentiation, © 1996. pp.239-253. ("Feehery").

11. The claim rejections are hereby summarized for Applicant's convenience. The detailed rejections follow.

- 12. Claims 1-2, 4-24, and 26-58 are rejected under 35 U.S.C. 102(b) as being anticipated by Feehery.**

13. In regards to Claim 1, Feehery teaches the following limitations:

1. A method of simulating a system, comprising:
  - establishing equations modeling the system using terms having characteristics encapsulated within the term;
  - performing symbolic processing on the established equations for simplification; and
  - performing system processing on the established equations for efficient simulation.

(See Feehery, especially: p.245. "On the other hand, the interpretive approach allows for very efficient manipulation of the DAE by merely adjusting the relevant data structures and performing differentiation in an incremental manner as necessary along the trajectory.")

14. In regards to Claim 2, Feehery teaches the following limitations:

2. The method of claim 1, wherein the stage of defining equations further includes:  
defining equations modeling the system using terms selected from one or more basic terms, composite terms, or collection terms.

(See Feehery, especially: especially: p.245. Examiner interprets that the data in the binary trees correspond to the claimed "terms".)

15. In regards to Claim 4, Feehery teaches the following limitations:

4. The method of claim 1, further including:  
defining a term group including one or more terms having related functionality;  
evaluating each term within the term group upon an initial request for evaluation of any of the one or more terms within the term group;  
storing the result of the evaluation for each of the one or more terms within the term group; and  
recalling the stored value of the evaluated one or more terms from the term group upon a subsequent request for evaluation of the one or more terms, without performing the evaluation stage.

(See Feehery, especially: especially: p.245. Examiner interprets that the data in the binary trees correspond to the claimed "terms", and the binary trees correspond to the claimed "term group".)

16. In regards to Claim 5, Feehery teaches the following limitations:

5. The method of claim 1, wherein the symbolic processing stage further includes reducing the established equations, utilizing the Pantelides algorithm, to a system of equations having a differential-algebraic system of equations index of at most one.

(See Feehery, especially: Section 2.1 "A Modified Pantelides' Algorithm")

17. In regards to Claim 6, Feehery teaches the following limitations:

6. The method of claim 5, wherein utilizing the Pantelides algorithm further includes:  
assigning equations to variables that have non-zero partial derivatives; and  
differentiating the remainder of the equations.

(See Feehery, especially: p.245. "Given this subset, the binary tree is analyzed using standard recursive algorithms to derive a set of binary trees representing the non zero partial derivatives of the function.")

18. In regards to Claim 7, Feehery teaches the following limitations:

7. The method of claim 5, wherein utilizing the Pantelides algorithm further includes:  
approximating an algebraic derivative for those equations that cannot be symbolically differentiated.

(See Feehery, especially: p.245. "The presence of common subexpressions and careful selection of the rules for differentiation [Rall1981a] can also be exploited to perform simultaneous function and gradient evaluations efficiently.")

19. In regards to Claim 8, Feehery teaches the following limitations:

8. The method of claim 5, wherein utilizing the Pantelides algorithm further includes:  
symbolically integrating equations that cannot be assigned.

(See Feehery, especially: p.245. "The presence of common subexpressions and careful selection of the rules for differentiation [Rall1981a] can also be exploited to perform simultaneous function and gradient evaluations efficiently.")

20. In regards to Claim 9, Feehery teaches the following limitations:

9. The method of claim 5, wherein utilizing the Pantelides algorithm further includes:  
differentiating equations that add output derivatives and integrating equations that add output integrals.

(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

21. In regards to Claim 10, Feehery teaches the following limitations:

10. The method of claim 5, wherein utilizing the Pantelides algorithm further includes:  
eliminating an integral as each symbolically differentiated or integrated equation eliminates a numeric integration, such that the integral is converted to an algebraic variable by eliminating the derivative or integral relationship.



(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

22. In regards to Claim 11, Feehery teaches the following limitations:

11. The method of claim 10, wherein eliminating an integral further includes:
  - assigning a preferred integration location rank to one or more integrals;
  - utilizing the preferred integration location rank, assigning integrals to equations; and
  - eliminating the integration of assigned or solved integral variables.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

23. In regards to Claim 12, Feehery teaches the following limitations:

12. The method of claim 11, wherein assigning a preferred integration location rank further includes:
  - assigning a preferred integration location to one or more integrals, the user assigned preferred integration location being given the highest available preferred integration location rank;
  - assigning a preferred integration location rank, wherein the preferred integration location rank has a lower rank than the user defined preferred integration location rank; and
  - assigning all other integration locations a default lowest rank.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

24. In regards to Claim 13, Feehery teaches the following limitations:

13. The method of claim 12, wherein the assigned preferred integration location is assigned by a user.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees

that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

25. In regards to Claim 14, Feehery teaches the following limitations:

14. The method of claim 12, wherein the assigned preferred integration location rank is assigned by a component developer.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

26. In regards to Claim 15, Feehery teaches the following limitations:

15. The method of claim 12, wherein utilizing the preferred integration location ranks to assign integrals to equations further includes:

identifying integral variables that appear linearly and nonlinearly in the integral equations; establishing a current preferred integration location rank at a default setting;

assigning each integral equation an integral variable that has a preferred integration location rank of less than the current preferred integration location rank, and, if possible, appears linearly in the equation; and repeating the previous three stages after increasing the current preferred integration location rank until a maximum preferred integration location rank has been exceeded.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

27. In regards to Claim 16, Feehery teaches the following limitations:

16. The method of claim 15, further including:  
solving each integral equation that is assigned an integral that appears linearly in it;  
substituting the solved value into other equations; and  
if due to substitutions, an one of the assigned variables is no longer in the equation, assign another integral with minimum integration rank to the one of the assigned variables.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

28. In regards to Claim 17, Feehery teaches the following limitations:

17. The method of claim 1, wherein the stage of performing system processing on the established equations further includes:  
performing system processing on an initial condition system apart from performing system processing on a transient system.

(See Feehery, especially: p.242, "2.1 A Modified Pantelides' Algorithm")

29. In regards to Claim 18, Feehery teaches the following limitations:

18. The method of claim 17, further including:  
defining user defined and component defined initial condition equations for the initial condition system.

(See Feehery, especially: p.242, "2.1 A Modified Pantelides' Algorithm")

30. In regards to Claim 19, Feehery teaches the following limitations:

19. The method of claim 17, further including:  
defining numeric integration equations for the transient system.

(See Feehery, especially: p.246. "... the cost of differentiation in ABACUSS is insignificant compared to that of numerical integration.")

31. In regards to Claim 20, Feehery teaches the following limitations:

20. The method of claim 1, wherein system processing further includes:  
replacing alias variables;  
partitioning the equations into blocks;  
tearing the blocks;  
sorting the blocks; and compressing equation terms.

(See Feehery, especially: p.240 "The DAE in this formulation has been partitioned into an index-1 DAE  $f$ , and a set of additional equations  $c$ , although this partitioning may be non-unique.")

32. In regards to Claim 21, Feehery teaches the following limitations:

21. The method of claim 20, wherein tearing the equations includes:  
    identifying block variables in the equations in the block in which the block variables appear linearly with constant coefficients;  
    solving nonlinear integration equations for their respective integrals;  
    solving the linear equations;  
    determining the solvability of the nonlinear equations;  
    solving the nonlinear equations utilizing iterates and block variables solved from the linear equations; and  
    scanning the solved variables for identification of variables that are independent and may be removed from the block.

(See Feehery, especially: pp.239-241, "1.2 Reasons for Solving High-Index DAEs")

33. In regards to Claim 22, Feehery teaches the following limitations:

22. The method of claim 20, wherein block sorting further includes:  
    defining and identifying the blocks as static blocks, dynamic blocks, or output blocks;  
    removing the static blocks from a list of blocks; and  
    removing the output blocks from the list of blocks.

(See Feehery, especially: pp.239-241, "1.2 Reasons for Solving High-Index DAEs")

**34. Claims 23-24 and 26-42 are rejected based on the same reasoning as claims 1-2, 4-12, and 15-22. Claims 23-24 and 26-42 are machine-readable medium claims that recite limitations equivalent to those recited in method claims 1-2, 4-12, and 15-22 and taught throughout Feehery.**

35. In regards to Claim 43, Feehery teaches the following limitations:

43. A method of symbolically processing a set of equations, comprising:  
    assigning a portion of the set of equations to variables that have non-zero partial derivatives;

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(See Feehery, especially: p.245. "Given this subset, the binary tree is analyzed using standard recursive algorithms to derive a set of binary trees representing the non zero partial derivatives of the function.")

- differentiating the remainder of the set of equations;
- approximating an algebraic derivative for those equations that cannot be symbolically differentiated;
- symbolically integrating equations that cannot be assigned;

(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

- differentiating equations that add output derivatives and integrating equations that add output integrals; and
- eliminating an integral as each symbolically differentiated or integrated equation eliminates a numeric integration, such that the integral is converted to an algebraic variable by eliminating the derivative or integral relationship.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

**36. Claim 44 is rejected based on the same reasoning as claim 43. Claim 44 is a machine-readable medium claim that recites limitations equivalent to those recited in method claim 43 and taught throughout Feehery.**

37. In regards to Claim 45, Feehery teaches the following limitations:

- 45. A method of eliminating an integral in a Pantelides algorithm, comprising:
  - assigning a preferred integration location rank to one or more integrals;

(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

- utilizing the preferred integration location rank, assigning integrals to equations; and
- eliminating the integration of assigned or solved integral variables.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

38. In regards to Claim 46, Feehery teaches the following limitations:

46. The method of claim 45, wherein assigning a preferred integration location rank, further includes:

assigning, by a user, a preferred integration location to one or more integrals, the user assigned preferred integration location being given the highest available preferred integration location rank;

(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

assigning, by a component developer, a preferred integration location rank, wherein the preferred integration location rank has a lower rank than the user defined preferred integration location rank; and  
assigning all other integration locations a default lowest rank.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

39. In regards to Claim 47, Feehery teaches the following limitations:

47. The method of claim 46, wherein utilizing the preferred integration location ranks to assign integrals to equations, further includes:

identifying integral variables that appear linearly and nonlinearly in the integral equations;

establishing a current preferred integration location rank at a default setting;

(See Feehery, especially: p.246. "... note from equation (9) that each partial derivative represents the sum over all the paths ...")

assigning each integral equation an integral variable that has a preferred integration location rank of less than the current preferred integration location rank and, if possible, appears linearly in the equation;  
and

repeating the previous three stages after increasing the current

preferred integration location rank until a maximum preferred integration location rank has been exceeded.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

40. In regards to Claim 48, Feehery teaches the following limitations:

48. The method of claim 47, further including:  
    solving each integral equation that is assigned an integral that appears linearly in it;  
    substituting the solved value into other equations; and  
    if due to substitutions, an one of the assigned variables is no longer in the equation, assign another integral with minimum integration rank to the one of the assigned variables.

(See Feehery, especially: p.246. "In the case of a combined function and gradient evaluation, correct application of the reverse mode algorithm guarantees that the binary product corresponding to each edge in the computational graph is evaluated exactly once ...")

**41. Claims 49-52 are rejected based on the same reasoning as claims 45-48.**

**Claims 49-52 are machine-readable medium claims that recite limitations equivalent to those recited in method claims 45-48 and taught throughout Feehery.**

42. In regards to Claim 53, Feehery teaches the following limitations:

53. A method of tearing equations, comprising:  
    identifying block variables in the equations in a block in which the block variables appear linearly with constant coefficients;  
    determining the solvability of the nonlinear equations;  
    solving nonlinear integration equations for their respective integrals;  
    solving the linear equations;  
    solving the nonlinear equations utilizing iterates and block variables solved from the linear equations; and  
    scanning for solved for variables for identification of variables that are independent and may be removed from the block.

(See Feehery, especially: "6. Demonstration and Numerical Results.")

**43. Claim 54 is rejected based on the same reasoning as claim 53. Claim 54 is a machine-readable medium claim that recites limitations equivalent to those recited in method claim 53 and taught throughout Feehery.**

44. In regards to Claim 55, Feehery teaches the following limitations:

55. A method of simulating a system, comprising:  
    establishing equations modeling the system using terms having characteristics encapsulated within the term;  
    performing symbolic processing on the established equations for reducing the number of terms in the equations; and  
    performing system processing on the established equations for efficient simulation.

(See Feehery, especially: "6. Demonstration and Numerical Results.")

45. In regards to Claim 56, Feehery teaches the following limitations:

56. The method of claim 55, further including:  
    defining a term group including one or more terms having related functionality;  
    evaluating each term within the term group upon an initial request for evaluation of any of the one or more terms within the term group; and  
    storing the result of the evaluation for each of the one or more terms within the term group.

(See Feehery, especially: "6. Demonstration and Numerical Results.")

46. In regards to Claim 57, Feehery teaches the following limitations:

57. The method of claim 56, further including:  
    recalling the stored value of the evaluated one or more terms from the term group upon a subsequent request for evaluation of the one or more terms, without performing the evaluation stage.

(See Feehery, especially: "6. Demonstration and Numerical Results.")



**47. Claim 58 is rejected based on the same reasoning as claim 55. Claim 58 is a method claim that recites limitations equivalent to those recited in method claim 55 and taught throughout Feehery.**

***Claim Rejections - 35 USC § 103***

48. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

49. This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

50. The prior art used for these rejections is as follows:

- Feehery, W.F. et al. "A Differentiation-Based Approach to Dynamic Simulation and Optimization with High-Index Differential-Algebraic

Equations.” SIAM Computational Differentiation, © 1996. pp.239-253.

(“Feehery”).

- “3.1 Associating Objects in C++”.

<http://people.cs.vt.edu/~kafura/cs2704/intro2.html>. Last Updated: July 3,

1996. Printed: 11/23/05. (“**Objects in C++**”).

51. The claim rejections are hereby summarized for Applicant’s convenience. The detailed rejections follow.

**52. Claims 3 and 25 are rejected under 35 U.S.C. 103(a) as being unpatentable over Feehery in view of Objects in C++.**

53. In regards to Claim 3, Feehery does not expressly teach the following limitations:

3. The method of claim 1, further including:  
extending a library of terms by defining new term classes, wherein term classes define objects having characteristics encapsulated within the objects.

The “Objects in C++” reference, on the other hand, does expressly teach those limitations (see especially pp.2-3).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the teachings of Feehery with those of “Objects in C++”, because it was old and well known to use an object-oriented language such as C++ in order to implement mathematical algorithms on a computer.

**54. Claim 25 is rejected based on the same reasoning as claim 3. Claim 25 is a machine-readable medium claim that recites limitations equivalent to those recited in method claim 3 and taught throughout Feehery and Objects in C++.**

***Conclusion***

55. The following prior art, made of record and not relied upon, is considered pertinent to applicant's disclosure.
56. "Publications of Paul I. Barton." <http://yoric.mit.edu/publications>. Printed 11/23/05. (Provides a publication date for the Feehery article).
57. Le Lann, J.M. et al. "Dynamic Simulation of Partial Differential Systems: Application to Some Chemical Engineering Problems." 3<sup>rd</sup> ICL Joint Conf. July 16-18, 1998. (Teaches effective realizations of partial differential algebraic equations - PDAEs).
58. "Publications & Communications." <http://www.prosim.net/publication>. Printed 11/23/05. (Provides a publication date of the Le Lann article).
59. Martinson, W. et al. "A Differentiation Index for Partial Differential-Algebraic Equations." SIAM J. Sci. Comput. © 2000. Vol.21, No.6, pp.2295-2315. (Teaches a differentiation index for Partial DAEs).
60. Pytlak, R. et al. "Optimal Control of Differential-Algebraic Equations without Impulses." Proc. of the 33<sup>rd</sup> Conf. on Decision and Control. Dec. 1994. pp.951-956. (Abstract teaches that higher order DAE systems have to be converted to index one systems, and this requires differentiation of algebraic equations. Also teaches a class of DAEs that can be optimized under reasonable assumptions).
61. Park, Taeshin et al. "State Event Location in Differential Algebraic Models." ACM Transactions on Modeling and Computer Simulation (TOMACS). April 1996.

Vol.6, Issue 2. pp.137-165. (Teaches an efficient discontinuity handling algorithm for initial value problems in differential-algebraic equations).

62. Zitney, S.E. et al. "Sparse Matrix Methods for Chemical Process Separation Calculations on Supercomputers." Proc. 1992 ACM/IEEE Conf. on High Performance Networking and Computing. 1992. pp.414-423. (Teaches the use of differential algebraic equation (DAE) systems at section 2.2 "SPEEDUP dynamic distillation").
63. U.S. Patent 6,556,954 to Denk et al. (Teaches the use of differential algebraic equation (DAE) index at col.2, lines 6-36, and col.3, lines 16-24, and col.6, lines 5-21)
64. U.S. PG-PUB 2003/0105618 to Estevez-Schwarz. (This publication does not qualify as prior art, but contains references to prior art at paragraphs [0048] to [0057]. In particular, paragraph [0055] teaches the use of a differential algebraic equation (DAE) index, which is taught in the prior art reference listed in para. [0048]).
65. U.S. PG-PUB 2003/0154059 to Feldmann et al. (This publication does not qualify as prior art. Teaches the use of differential equation system "high index" at paragraphs [0015] and [0072]).
66. U.S. PG-PUB 2004/0133407 to Reissig. (This publication does not qualify as prior art, but contains references to prior art at paragraph [0007]. Teaches the use of differential algebraic equation "index" at paragraphs [0006] and [0007], and specifically makes reference at para. [0007] to a prior art article by Reissig

that teaches that when applied to DAE with an index of 1, Pantelides' algorithm can execute an arbitrarily high number of iterations and differentiations).

67. U.S. PG-PUB 2005/0071137 to Selvaraj et al. (This publication does not qualify as prior art, but contains a reference to a prior art article by Pantelides in para. [0002]).

68. U.S. PG-PUB 2005/0107895 to Pistikopoulos et al. (This publication does not qualify as prior art, but contains a reference to a prior art article by Pantelides in para. [0152]).

### ***Correspondence Information***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Ayal I. Sharon whose telephone number is (571) 272-3714. The examiner can normally be reached on Monday through Thursday, and the first Friday of a bi-week, 8:30 am – 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Leo Picard can be reached at (571) 272-3749.

Any response to this office action should be faxed to (571) 273-8300, or mailed to:

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Alexandria, VA 22313-1450

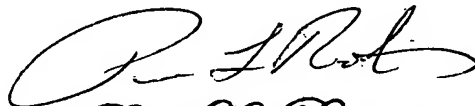
or hand carried to:

Art Unit: 2123

USPTO  
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Alexandria, VA 22314

Any inquiry of a general nature or relating to the status of this application or proceeding should be directed to the Tech Center 2100 Receptionist, whose telephone number is (571) 272-2100.

Ayal I. Sharon  
Art Unit 2123  
November 23, 2005

  
Paul L. Rodriguez 11/28/05  
Primary Examiner  
Art Unit 2125